Lloyd's Register

Rules and Regulations for the Classification of Special Service Craft, July 2011

Notice No. 5

Effective Date of Latest Amendments:

See page 1

Issue date: May 2012

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RULES AND REGULATIONS FOR THE CLASSIFICATION OF SPECIAL SERVICE CRAFT, *July 2011*

Notice No. 5

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Classification of Special Service Craft, July 2011.* The amendments are effective on the dates shown:

Part	***Chapter***	***Section***	***Effective date***
9	1	1	1 July 2012
10	1	8	1 July 2012
13	4	1	1 July 2012
15	1	9	1 July 2012
16	1	1, 2, 3, 4	1 July 2012
16	2	16	1 January 2012
16	2	1, 5, 7, 8, 10, 11, 20	1 July 2012
17	1	1	1 July 2012

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Classification of Special Service Craft, July 2011* are to be read in conjunction with this Notice No. 5. The status of the Rules is now:

Rules for Special Service Craft	Effective date:	July 2011
Notice No. 1	Effective date:	1 January 2012
Notice No. 2	Effective date:	1 January 2012
Notice No. 3	Effective date:	1 January 2012
Notice No. 4	Effective date:	1 July 2012
Notice No. 5	Effective date:	1 January 2012 & 1 July 2012

Part 9, Chapter 1

General Requirements for Machinery

Effective date 1 July, 2012

Section 1
General requirements

1.1 Application

1.1.1 Parts 9 to 16 apply to the design, construction, installation and testing of:

- Main propulsion machinery systems.
- Essential auxiliary machinery systems, excluding the crankshaft for diesel engines intended for essential services where power does not exceed 110 kW. ~~except where stated otherwise~~
- Steering and manoeuvring systems.

together with their associated equipment, pressure plant, piping systems, control engineering and electrical engineering systems for the craft types stated in Pt 1, Ch 2,1.

Part 10, Chapter 1

Diesel Engines

Effective date 1 July, 2012

Section 8
Piping systems

8.6 Inlet and exhaust systems

8.6.5 Plastic pipes intended for exhaust systems are to be in accordance with a recognised Code or Standard suitable for the intended service conditions.

Part 13, Chapter 4

Shaft Vibration and Alignment

Effective date 1 July, 2012

■ *Section 1*

Shaft alignment

1.2 Particulars to be submitted for approval – Shaft alignment calculations

1.2.1 Shaft alignment calculations are to be submitted to Lloyd's Register (hereinafter referred to as 'LR') for approval for the following shafting systems ~~where the screwshaft has a diameter of 250 mm or greater in way of the aftermost sterntube bearing~~:

(a) All geared installations where the screwshaft has a diameter of 300 mm or greater in way of the aftmost bearing.

(b) ~~Installations with one shaftline bearing, or less, inboard of the forward sterntube bearing.~~ All direct drive installations which incorporate three or fewer bearings supporting the intermediate and screwshaft aft of the prime mover.

(c) Where prime movers or shaftline bearings are installed on resilient mountings.

Part 15, Chapter 1

Piping Design Requirements

~~**Effective date 1 January, 2012**~~
Effective date 1 July, 2012
(*Updates Notice 2*)

■ *Section 9*

Austenitic stainless steel

9.1 General

9.1.2 The minimum thickness of stainless steel pipes is to be determined from the formula given in 5.1.2 or 5.1.3 using a corrosion allowance of 0,8 mm. Values of the ~~0,2~~ 1,0 per cent proof stress and tensile strength of the material for use in the formula in 5.1.6 may be obtained from Table 6.5.2 in Chapter 6 of the Rules for Materials.

9.1.3 Where stainless steel is used in lubricating oil and hydraulic oil systems, the corrosion allowance may be reduced to ~~0,3~~ 0 mm.

Part 16, Chapter 1

Control Engineering Systems

Effective date 1 July, 2012

■ *Section 1*
General requirements

1.2 Plans and information

1.2.4 **Alarm systems**. Details of the overall alarm system linking the main control station, subsidiary control stations, the bridge area and accommodation. Details of alarms and warnings presented by the user interface including: an approach to category assignment which is in accordance with the IMO *Code on Alerts and Indicators, 2009*; and for alarms required by these Rules, the intended operator response and the message is to be presented.

1.2.7 **Control station**. ~~Location and details of control stations, e.g. control panels and consoles.~~ Plans showing the location and details of control stations, e.g., control panels and consoles. Location and details of controls and displays on each panel. Details of user interface specifications. A general arrangement plan of control rooms showing the position of consoles, handrails, operator area, lighting, door and window arrangements. Drawing of HVAC systems including vent arrangements.

~~*1.2.9* **Approved system**. Where it is intended to employ a standard system which has been previously approved, plans are not required to be submitted, providing there have been no changes in the applicable Rule requirements. Details of the previous approval are to be submitted.~~

Existing paragraph 1.2.10 *has been renumbered* 1.2.9.

■ *Section 2*
Essential features for control, alarm and safety systems

2.1 General

2.1.1 Where it is proposed to install control, alarm and safety systems to the machinery and equipment listed in 1.2.2, the applicable features contained in this Section are to be incorporated in the system design.

2.2 Control stations for machinery

2.2.1 A system of alarm and warning displays and controls is to be provided which readily ensures identification of faults in the machinery and satisfactory supervision of related equipment by duty personnel. This may be provided at a main control station or, alternatively at subsidiary control stations. In the latter case, a master alarm display is to be provided at the main control station showing which of the subsidiary control stations is indicating a fault condition.

2.2.3 Where operator interfaces are installed in the wheelhouse, illumination should not interfere with night vision. All illumination and lighting of instruments, keyboards and controls are to be adjustable to zero illumination, except for lighting for visual indication of alarms and the controls of dimmers, which are to remain readable.

Existing paragraphs 2.2.3 *to* 2.2.7 *have been renumbered* 2.2.4 *to* 2.2.8.

2.3 Alarm systems

2.3.1 Where an alarm system, which will ~~provide warning of faults~~ alert relevant personnel to faults, abnormal situations and other conditions requiring attention in the machinery and the safety and control systems required by this Chapter or other Sections of the Rules is to be installed, the requirements of 2.3.2 to ~~2.3.18~~ 2.3.20 are to be satisfied.

2.3.3 Alarms and warnings associated with machinery and equipment required to satisfy this sub-Section are to be categorised according to the urgency and type of response required by the crew, as described in the IMO *Code on Alerts and Indicators, 2009*. The assignment of the category to each alert is to be evaluated on the basis not only of the machinery or equipment being monitored, but also the complete installation. Categories not included in an alarm system may be omitted from the system design. Details of alternative alert management proposals supported with evidence of service experience, may be submitted for consideration by LR.

2.3.4 Where the facility to provide messages in association with alarms and warnings exists, messages accompanying alarms and warnings are to describe the condition and indicate the intended response required by the crew.

~~*2.3.3* Alarms associated with machinery, safety and control system faults are to be clearly distinguishable from other alarms e.g. fire, general alarm.~~

2.3.5 Where the facility to provide messages in association with alarms and warnings exists, messages of different categories are to be clearly distinguishable from each other.

~~*2.3.4*~~ *2.3.6* Where alarms are displayed as group alarms, provision is to be made to identify individual alarms at the main control station (if fitted) or alternatively at subsidiary control stations.

~~*2.3.5*~~ *2.3.7* All alarms are to be both audible and visual. If arrangements are made to silence audible ~~alarms~~ signals, they are not to extinguish visual ~~alarms~~ indications.

~~*2.3.6*~~ *2.3.8* Acknowledgement of visual alarms is to be clearly indicated.

~~*2.3.7*~~ *2.3.9* Acknowledgement of alarms at positions outside a machinery space is not to silence the audible ~~alarm~~ signal or extinguish the visual ~~alarm~~ indication in that machinery space.

~~*2.3.8*~~ *2.3.10* If an alarm has been acknowledged and a second fault occurs prior to the first being rectified, audible signals and visual ~~alarms~~ indications are again to operate. Where alarms are displayed at a local panel adjacent to the machinery and with arrangements to provide a group or common fault alarm ~~at the main~~ in the control room ~~alarm display~~ then the occurrence of a second fault prior to the first alarm being rectified need only be displayed at the local panel, however the group alarm is to be reinitiated. Unacknowledged alarms on monitors are to be distinguished by either flashing text or a flashing marker adjacent to the text. A change of colour will not in itself be sufficient to distinguish between acknowledged and unacknowledged alarms.

Existing paragraphs 2.3.9 *to* 2.3.14 *have been renumbered* 2.3.11 *to* 2.3.16.

~~*2.3.15*~~ *2.3.17* Disconnection or manual overriding of any part of the alarm system ~~should~~ is to be clearly indicated.

~~*2.3.16*~~ *2.3.18* When alarm systems are provided with means to adjust their set point, the arrangements are to be such that the final settings can be readily identified.

~~*2.3.17*~~ *2.3.19* Where monitors are provided at the station in control and, if fitted, in the duty engineer's accommodation, they are to provide immediate display of new alarm information regardless of the information display page currently selected. This may be achieved by provision of a dedicated alarm monitor, a dedicated area of screen for alarms or other suitable means.

~~*2.3.18*~~ *2.3.20* ~~Alarms~~ Where practicable, alarms displayed on monitors are to be displayed in the order in which they occur. Alarms requiring manual shutdown or slowdown action are to be given visual prominence.

2.5 Control systems

2.5.8 Remote or automatic controls are to be provided with sufficient instrumentation at the relevant control stations to ensure effective control by duty personnel and to indicate that the system is functioning correctly.

2.5.11 Failure of a control system is not to result in the loss of ability to provide essential services by alternative means. This may be achieved by manual control or redundancy within the control system or redundancy in machinery and equipment, *see also* 2.13.2. Instrumentation is to be provided at local manual control stations to ensure effective operation of the machinery by duty personnel.

2.8 Fire detection alarm systems

2.8.4 An audible fire-alarm signal is to be provided having a characteristic which distinguishes it from the alarm ~~system~~ signal required by 2.3 or any other alarm signal. The audible fire-alarm signal is to be immediately audible on all parts of the navigating bridge, at the fire control station and the machinery control stations, and throughout the crew accommodation areas and the machinery spaces.

2.8.6 The alarm system is to be designed with self-monitoring properties and system failures are to initiate an audible and visual alarm distinguishable from the fire alarm signal. This alarm may be incorporated in the machinery alarm system.

2.9 Fixed water-based local application fire-fighting systems

2.9.5 A control panel is to be provided for managing actions such as opening of valves, starting of pumps and ~~sounding~~ initiation of alarms and warnings and processing information from detectors. This panel is to be independent of the fire detection control unit required by 2.8.

2.10 Programmable electronic systems – General requirements

~~*2.10.16* User interfaces are to be designed in accordance with appropriate ergonomic principles to meet user needs and enable timely access to desired information or control of functions. A system overview is to be readily available.~~

~~*2.10.17* The keyboard is to be divided logically into functional areas. Alphanumeric, paging and specific system keys are to be grouped separately.~~

~~*2.10.18* Where a function may be accessed from more than one interface, the arrangement of displays and controls is to be consistent.~~

~~*2.10.19* The size, colour and density of information displayed to the operator are to be such that information may be easily read from the normal operator position under all operational lighting conditions.~~

~~*2.10.20*~~ *2.10.16* Display units are to comply with the requirements of an acceptable National or International Standard e.g. IEC 60950:~~1999~~ 2005, *Safety of information technology equipment,* in respect of emission of ionising radiation.

~~*2.10.21* Symbols used in mimic diagrams are to be visually representative and are to be consistent throughout the systems' displays.~~

Existing paragraphs 2.10.22 *to* 2.10.25 *have been renumbered* 2.10.17 *to* 2.10.20.

■ *Section 3*
Ergonomics of control stations

3.1 Objectives

3.1.1 In order to take account of operator tasks at control stations, enhance usability and reduce human error, the layout arrangements are to comply with the requirements set out in 3.2.

3.1.2 In order to establish a working environment that has minimum distractions, is sufficiently comfortable, helps maintain vigilance and maximises communication amongst operators at main control stations, the requirements of 3.3 are to be complied with.

3.1.3 The requirements of 3.4 to 3.6 apply to operator interfaces for essential engineering systems located either locally, remotely or within the main control room. The requirements are intended to enhance the usability of systems and equipment, reduce human error, enhance situational awareness and support safe and effective monitoring and control under normal and abnormal modes of operation.

3.2 Control station layout

3.2.1 Control stations are to provide sufficient space and access for the intended number of operators in the expected operating conditions.

3.2.2 Local control stations are to be positioned to minimise the risk of harm to the operator.

3.2.3 Controls, displays and indicators are to be both logically and physically grouped according to their function.

3.2.4 Where a function may be accessed from more than one interface, the arrangement of displays and controls is to be consistent.

3.2.5 Frequently used controls and displays are to be within easy reach and visible to the operator from the normal working position.

3.2.6 Controls and displays used infrequently and which may be used in an emergency are to be clearly identifiable, clearly visible, easily accessible and positioned to allow safe operability.

3.2.7 The relationship of a control with a display is to be immediately apparent.

3.2.8 The relationship of controls and displays with the equipment under control is to be immediately apparent.

3.2.9 There is to be adequate spacing between controls and between controls and obstructions.

3.2.10 Controls and their associated displays are to be located such that the information on the displays can be easily read during the operation of the controls.

3.2.11 Indicators related to the controls are to be visible during their operation.

3.2.12 Instruments are to face the operator's intended working position.

3.3 Physical environment

3.3.1 Control stations are to be positioned, as far as practicable, away from, or insulated against, sources of structurally transmitted noise, such as ventilation fans, engine intake fans and other noise sources.

3.3.2 In general, noise levels are to comply with IMO Res. A.468(XII), Code on Noise Levels on Board Ships, and are to take into account IMO Res. A.343(IX), *Recommendation on Methods of Measuring Noise; Levels at Listening Posts*.

3.3.3 Where provided, the heating, ventilation and air-conditioning system is to be capable of maintaining the temperature between 18°C and 27°C.

3.3.4 The flow of air from heating or air-conditioning systems is not to be guided directly to the operator, or means are to be provided to adjust the direction of airflow from those systems.

3.3.5 Lighting is to be located to avoid glare from working and display surfaces, and is to be flicker-free. Surfaces are to have a non-reflective or matt finish.

3.3.6 Placement of controls, displays and indicators are to consider the position of light sources relative to the operator with respect to reflections and evenness of lighting.

3.3.7 Where a transparent cover is fitted over a control, display or indicator, it is to be designed to minimise reflections.

3.3.8 The level of lighting is to be sufficient to enable operation of user interfaces. Lighting levels, in accordance with Table 1.3.1, will be considered to satisfy this requirement.

Table 1.3.1 Specific lighting levels

Work area	Ideal Lux	Minimum Lux
General lighting	540	220
Control room consoles (front)	540	320
Control room consoles (rear)	325	110
Local operating panels	540	320
Remote operating panels	540	320

3.3.9 Chairs provided for use at control stations are to be adjustable to allow for varying heights of operators.

3.3.10 Physical hazards, e.g., sharp edges, protuberances and trip hazards, are to be avoided.

3.3.11 Sufficient handrails or equivalent are to be fitted to enable operators to move and stand safely in rough seas.

3.3.12 Work surfaces are to be capable of withstanding oils and solvents common to ships and are to be easy to clean.

3.4 Operator interface

3.4.1 The design of the operator interface is to permit the satisfactory monitoring, control and supervision of the machinery and equipment.

3.4.2 Information is to be presented to the operator consistently, both within and between different interfaces, *see* 3.6.2 to 3.6.4.

3.4.3 The response of the machinery and equipment to operator input is to be consistent between interfaces for the same function.

3.4.4 Visual, audible or mechanical feedback is to be provided to indicate that operator input has been acknowledged.

3.4.5 Functions requested by the operator are to be confirmed by the displays on completion.

3.4.6 Indications and documentation are to be in English or the language of the crew.

3.5 Controls

3.5.1 Operator inputs are to be checked for errors, for example, out of range data or incorrect actions, and alert the operator when they occur.

3.5.2 Means to rapidly and safely correct wrong inputs or commands is to be provided.

3.5.3 Assistance is to be provided to the operator to recover from operating errors, for example, through advisory screens where the automation system has this facility.

3.5.4 Operator confirmation is to be provided for any control action that could affect the safety of the ship, i.e. they should not rely on single keystrokes.

3.5.5 The purpose of each control is to be clearly indicated. Where standard symbols have been internationally adopted, they should be used.

3.5.6 The settings of mechanical controls are to be immediately evident.

3.5.7 The means of operation of mechanical controls is to be consistent with expectations.

3.5.8 Controls or combined controls and indicators are to be distinguishable from indicators.

3.5.9 Where control is provided by touch screens, the size of the soft keys are to be of a sufficient size for operation in areas where vibration occurs or gloves are likely to be worn.

3.5.10 Where virtual keypads/keyboards or dialogue boxes are used on touch screens, they are not to obscure status or alarm areas of the display.

3.5.11 Keyboards are to be divided logically into functional areas. Alphanumeric, paging and specific keys are to be grouped separately.

3.6 Displays

3.6.1 The displays and indicators are to present the operator with clear, timely and relevant information.

3.6.2 Graphical symbols and colour coding are to be consistent. The graphical symbols of display functions are to be in accordance with a recognised International Standard, for example, ISO 14617, *Graphical symbols for diagrams.* Colour coding of functions and signals is to be in accordance with a recognised International Standard, for example, ISO 2412:1982, *Shipbuilding – Colours of indicator lights.*

3.6.3 The symbols used in mimic diagrams for the services listed in Pt 16, Ch 2,1.5.1 are to be consistent across all displays.

3.6.4 The display of information is to be consistent with respect to screen layout and arrangement of information.

3.6.5 Flashing of information is to be reserved for unacknowledged alerts, or transient states, for example, valve moving.

3.6.6 The functions supported by a display are to be clearly indicated. For displays that can support multiple functions, it is to be possible to select the display associated with the primary function or an overview by a simple operator action.

3.6.7 The operating mode of the machinery and equipment is to be clearly indicated.

3.6.8 In general, indications provided by instrumentation which are displayed digitally are not to change more frequently than twice per second.

3.6.9 To indicate an increasing value in a single direction, on a fixed circular scale, the pointer is to move clockwise. If the pointer is fixed, the scale is to move anticlockwise to indicate an increase in value.

3.6.10 To indicate an increasing value on a horizontal linear scale, the pointer is to move from left to right. On a vertical linear scale, the pointer is to move upwards to indicate an increase in value.

3.6.11 The pointer is not to obscure the numbers on the scale.

3.6.12 Alphanumeric data, text, symbols and other graphical information is to be readable from relevant operator positions under lighting conditions as specified in 3.3.8. Character height in millimetres is to be not less than three and a half times the reading distance in metres and the character width is to be 0,7 times the character height.

3.6.13 A simple sans-serif character font is to be used in displays. In descriptive text, lower case letters are to be used, where appropriate, as opposed to capitals to improve readability.

3.6.14 Where information related to the safe operation of machinery and equipment is provided, it is to be continuously available to the operator.

3.6.15 Failures are to be indicated in a clear and unambiguous manner. Sufficient information is to be provided for the operator to identify the cause of the failure.

Existing Sections 3 *to* 6 *have been renumbered* Sections 4 *to* 7.

■ *Section ~~3~~ 4*
Unattended machinery space(s) – UMS notation

~~3.2~~ 4.2 Alarm system for machinery

~~3.2.3~~ 4.2.3 The engineers' alarm required by 2.2.3 is to be activated automatically in the event that a machinery alarm or warning has not been acknowledged in the space within a predetermined time.

Part 16, Chapter 2
Electrical Engineering

Effective date 1 July, 2012

■ *Section 1*
General requirements

1.2 Plans required for design review

1.2.1 ~~At least three copies of the plans and particulars in 1.2.2 to 1.2.8 are to be submitted for consideration. Single copies only are required of plans in 1.2.10 to 1.2.13. Additional copies are to be submitted when requested.~~ The plans and particulars in 1.2.2 to 1.2.13 are to be submitted for design review.

1.2.3 A description of operation of the main and emergency electrical power systems.

1.2.4 An earthing philosophy document that defines the basic approach to be taken for earthing the electrical power systems and all electrical loads.

Existing paragraphs 1.2.3 *and* 1.2.4 *have been renumbered* 1.2.5 *and* 1.2.6.

1.2.7 Where required by 8.1.1, the hazards resulting from electric arcs within electrical equipment and their consequences for personnel are to be identified, and at least the following supporting evidence is to be submitted:

(a) system design;

(b) operating philosophies, e.g., manual or automatic control, local or remote operation;

(c) general arrangement plans for switchboards, section boards and distribution boards, *see also* 1.2.14;

(d) general arrangement plans for the space in which the electrical equipment to be assessed are located, showing:

   (i) access to adjacent spaces;

   (ii) the location of the electrical equipment;

   (iii) ventilation arrangements for air-conditioning and/or the extraction of smoke, gas and vapours resulting from electric arcs; and

   (iv) positions within the space in which the electrical equipment is located where personnel will be performing tasks, e.g., switching, equipment maintenance, instrument observation or cleaning, or where personnel could be reasonably expected to enter;

(e) calculations in accordance with 8.3;

(f) system operating procedures; and

(g) details of defined additional safety measures to be taken during activities.

Existing paragraphs 1.2.5 *to* 1.2.7 *have been renumbered* 1.2.8 *to* 1.2.10.

~~1.2.8~~ 1.2.11 Details of electrically-operated fire, craft, crew and passenger emergency safety systems which are to include typical single line diagrams and arrangements, showing main vertical and, where applicable, horizontal fire zones and the location of equipment and cable routes, including identification of relevant high fire risk areas, to be employed for:

(a) emergency lighting;

(b) accommodation fire detection, alarm and extinction systems;

(c) fixed water-based local application fire-fighting systems;

(d) public address system;

(e) general emergency alarm;

(f) watertight doors, shell doors and other electrically operated closing appliances; and

(g) low location lighting.

NOTE

A general arrangement plan of the complete craft showing the main vertical fire zones and the location of equipment and cable routes, including identification of relevant high fire risk areas, for the above systems, is to be made available for the use of the Surveyor on board.

~~1.2.9~~ 1.2.12 Evidence of the suitability of electrical and electronic equipment for use in protected areas and adjacent areas, as required by 16.3.11 and 16.3.12, including a schedule of electrical and electronic equipment located in protected areas and adjacent areas, and general arrangement plans showing the coverage of the protected areas and adjacent areas.

~~1.2.12~~ 1.2.13 Schedule of normal and emergency operating loads on the system estimated for the different operating conditions expected. The following details are to be provided to meet this requirement:

(a) a description of the expected operating profiles (e.g. the number of generating sets connected when manoeuvring, at sea, etc.), including as required by Pt 5, Ch 2,1.1.1; and
(b) a schedule of the normal and emergency operating loads, which is to state the kilowatt rating of each load and a load factor between 0 and 1 that reflects:
  (i) the duty cycle of the load; and
  (ii) the proportion of its maximum rating at which the load is expected to operate.

1.3 Plans required for supporting evidence

1.3.1 The plans and particulars in 1.3.2 to 1.3.5 are to be submitted as supporting evidence.

~~1.2.10~~ 1.3.2 In order to establish compliance with 1.10.2 and 5.1.3 to 5.1.5, a general arrangement plan of the craft showing the location of major items of electrical equipment, for example:

- main and emergency generators;
- switchboards;
- section boards and distribution boards supplying essential and emergency services;
- emergency batteries;
- motors for emergency services; and
- cable routes between these items of equipment.

~~1.2.11~~ 1.3.3 Arrangement plans of main and emergency switchboards, and section boards, and documentation that demonstrates that creepage and clearance distances are in accordance with 7.5.

~~1.2.13~~ 1.3.4 In order to establish compliance with the requirements of ~~1.6.3,~~ 1.7.3, when requested, evidence is to be submitted to demonstrate the suitability of electrical equipment for its intended purpose in the conditions in which it is expected to operate.

~~1.2.14~~ 1.3.5 For non-metallic cable support systems or protective casings, test evidence, details of installation procedures and manufacturer's recommendations that show compliance with 10.13.

Existing sub-Sections 1.3 *and* 1.4 *have been renumbered* *1.4.and* 1.5.

~~1.5~~ 1.6 Definitions

1.6.15 An 'electric arc' is an electrical discharge or a short-circuit through ionised air caused by isolation or insulation integrity failure.

1.6.16 'Incident energy' is the amount of energy impressed on a surface, a certain distance from the source, generated during an electric arc event.

Existing sub-Sections 1.6 *to* 1.9 *have been renumbered* 1.7 *to* 1.10.

~~1.10~~ 1.11 Location and construction

Existing paragraphs 1.10.1 *to* 1.10.7 *have been renumbered* 1.11.1 *to* 1.11.7.

1.11.8 The design of equipment is to enable ease of access to all parts requiring inspection or replacement in service.

Existing paragraphs 1.10.8 *to* 1.10.10 *have been renumbered* 1.11.9 *to* 1.11.11.

1.11.12 To allow ease of access, connectors are to be spaced far enough apart to permit connection and disconnection. At test points, adequate clearance is to be provided between connection points and controls to provide access for testing.

Existing paragraphs 1.10.11 *and* 1.10.12 *have been renumbered* 1.11.13 *and* 1.11.14.

~~1.11~~ 1.12 Earthing of non-current carrying parts

Existing paragraphs 1.11.1 *to* 1.11.8 *have been renumbered* 1.12.1 *to* 1.12.8.

~~1.11.9~~ 1.12.9 The connection of the earthing conductor to the hull of the craft is to be made in an accessible position, and is to be secured by a screw or stud of a diameter appropriate for the size of earthing conductor, but not less than 6 mm which is to be used for this purpose only. Bright metallic surfaces at the contact areas are to be ensured immediately before the nut or screw is tightened and, where necessary, the joint is to be protected against electrolytic corrosion. The connection is to remain unpainted.

~~1.12~~ 1.13 Electrical bonding for the control of static electricity

Existing paragraphs 1.12.1 *and* 1.12.2 *have been renumbered* 1.13.1 *and* 1.13.2.

~~1.12.3~~ 1.13.3 Where bonding straps are required for the control of static electricity, they are to be robust, that is, having a cross-sectional area of ~~about~~ at least 10 mm^2, and are to comply with 1.11.7 and 1.11.9.

1.14 Labels, signs and notices

1.14.1 Labels, signs and notices required by this Chapter are to be positioned in clearly visible locations which will not be obscured.

1.14.2 Labels, signs and notices are to be easy to read under the expected operating conditions. Character height in accordance with Table 2.1.1 will be considered to satisfy this requirement.

1.14.3 Controls, indicators and displays required by this Chapter are to be labelled to indicate their function. Labels are to be positioned in a manner that associates the label with the item being labelled.

1.14.4 Labels, signs and notices are to use short, clear messages. In general, warning signs and notices are to comprise:
- a word signalling the gravity of the risk (e.g., Danger, Warning or Caution);
- a statement of the nature and/or consequence of the hazard; and
- wherever practical, an instruction giving appropriate behaviour to avoid the hazard.

Table 2.1.1 Character height and viewing distance

Work area	Minimum character height (mm)
Less than 500	2,3
500–1000	4,7
1000–2000	9,4
2000–4000	19
4000–8000	38

~~1.13~~ 1.15 Alarms

~~*1.13.1*~~ *1.15.1* Where alarms are required by this Chapter they are to be arranged in accordance with Ch 1,2.3. Sound signal equipment, fire and general alarm bells are not required to be supplemented by visual ~~alarms~~ indications, except in areas having high levels of background noise, such as machinery spaces.

Existing paragraphs 1.13.2 *to* 1.13.4 *have been renumbered* 1.15.2 *to* 1.15.4.

~~1.14~~ 1.16 Operation under fire conditions

~~*1.14.1*~~ *1.16.1* As a minimum, the following emergency services and their emergency power supplies, are required to be capable of being operated under fire conditions:
- Emergency fire pump.
- Fire safety stops, *see also* 16.6.
- Control and power systems to power-operated fire doors and ~~their~~ status indication for all fire doors.
- Control and power systems to power-operated watertight doors and their status indication.
- Emergency lighting.
- Fire and general alarms.
- Fire detection systems.
- Fire-extinguishing systems and fire-extinguishing media release alarms.
- Low location lighting, *see also* 17.4.3.
- Public address systems.

Existing sub-Sections 1.15 *and* 1.16 *have been renumbered* 1.17 *and* 1.18.

■ *Section 5*
Supply and distribution

5.4 Insulated distribution systems

5.4.1 A device(s) is to be installed for every insulated distribution system, whether primary or secondary, for power, heating and lighting circuits, to continuously monitor the insulation level to earth and to operate an alarm in the engine control room, or equivalent attended position, in the event of an abnormally low level of insulation resistance.

■ *Section 7*
Switchgear and control gear assemblies

7.1 General requirements

7.1.1 Switchgear and control gear assemblies and their components are to comply with one of the following standards amended where necessary for ambient temperature and other environmental conditions:

(a) IEC ~~60439~~ 61439: *Low voltage switchgear and control gear assemblies*;
(b) IEC 62271-200*: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*;
(c) IEC 60466: *AC insulated-enclosed switchgear for rated voltages above 1 kV and up to and including 38 kV*;
(d) IEC 60255: *Electrical relays*;
(e) acceptable and relevant National Standard.

In addition, the requirements of 7.2 to 7.18 are to be complied with.

7.5 Creepage and clearance distances

~~*7.5.3* Creepage distances cannot be accurately specified as they depend upon the insulating material, dust deposits, humidity, etc. They are to be not less than the clearance distances given in Table 2.7.1, or less than 16 mm per 1000 V (rated voltage), whichever is the greater.~~

7.5.3 Switchgear and control gear assemblies for rated voltages up to and including 1 kV are to have creepage distances in accordance with IEC 60092-302, *Electrical installations in ships – Part 302: Low-voltage switchgear and control gear assemblie*s, and Table 2.7.2.

7.5.4 For switchgear and control gear assemblies for rated voltages up to and including 1 kV, a minimum creepage distance of 16 mm is permitted for type-tested assemblies. The type tests are to include verification of the degree of protection, insulation material group and creepage and clearance distances in accordance with IEC 61439-1, *Low-voltage switchgear and control gear assemblies – Part 1: General Rules*.

7.5.5 Switchgear and control gear assemblies for rated voltages above 1 kV are to have creepage distances in accordance with IEC 60092-503, *Electrical installations in ships – Part 503: Special features – AC supply systems with voltages in the range of above 1 kV up to and including 15 kV*. In the absence of alternative proposals, including supporting design rationale, the distances stated in Table 2.7.2 are to be used, *see also* 1.2.16.

7.5.6 For switchgear and control gear assemblies for rated voltages of 1 kV and above, the type testing stated in Table 2.7.1 is to include verification of the degree of protection in accordance with a relevant International or National Standard.

~~Table 2.7.1 Minimum clearance distances~~

~~Rated voltage V~~	~~Minimum clearance (mm) between phases and earth~~		~~Minimum clearance (mm) between phases~~
	~~Earthed neutral~~	~~Insulated neutral~~	
~~≤ 660~~	~~16~~	~~19~~	~~19~~
~~1000~~	~~25~~	~~25~~	~~25~~
~~3600~~	~~55~~	~~55~~	~~55~~
~~7200~~	~~70~~	~~100~~	~~100~~
~~12000~~	~~85~~	~~140~~	~~140~~
~~15000~~	~~100~~	~~165~~	~~165~~

Table 2.7.1 Minimum clearance distances

Nominal voltage (V)	Minimum clearance distance (mm)			
	Main switchboards		Other switchgear and control gear	
	Type-tested assemblies	Non-type-tested assemblies	Type-tested assemblies	Non-type-tested assemblies
≤ 250	8	15	6	15
>250 to ≤690	8	20	6	20
>690 to 1000	8	25	6	25
<1100	14	14	14	14
<3300	32	55	26	55
<6600	60	90	50	90
<11 000	100	120	80	120
≤15 000	100	160	100	160

NOTE
A minimum clearance distance of 25 mm is required for busbars and other bare conductors in main switchboards.

Table 2.7.2 Minimum creepage distances

Nominal voltage (V)	Minimum creepage distance (mm)	
	Main switchboards	Other switchgear and control gear
≤250	20	20
>250 to ≤690	25	25
>690 to 1000	35	35
<3300	48	35
<6600	90	70
<11,000	150	120
≤15,000	150	120

NOTE
A minimum creepage distance of 16 mm is permitted for type-tested assemblies for rated voltages up to and including 1 kV, *see* 7.8.4.

7.8 Earthing of high-voltage switchboards

7.8.2 Protective shutters associated with withdrawable parts are to be clearly marked, e.g. by colour coding, to indicate the incoming and outgoing circuits and bus tie connections.

7.12 Instrument scales

7.12.5 In general, indications provided by instrumentation which are displayed digitally are not to change more frequently than twice per second.

Section 8

Protection of personnel from hazards resulting from electric arcs within electrical equipment assemblies and enclosures

8.1 General

8.1.1 An assessment is to be carried out in accordance with 8.2.1 for all electrical equipment within which an arcing fault could occur, such as:

- harmonic filters;
- motor starter panels;
- semiconductor converters;
- switchboards, section boards and distribution boards; or
- transformers.

8.2 Hazard identification and assessment

8.2.1 An assessment is to be carried out to identify the hazards and their consequences for personnel resulting from electric arcs within the electrical equipment identified in 8.1.1. The purpose of the assessment is to demonstrate that the design incorporates adequate measures to reduce the risk of injury to personnel should an arcing fault occur within the electrical equipment, and that this will help to ensure both personnel and ship safety. Details of the following are to be submitted:

(a) each task to be performed, e.g. switching, equipment maintenance, instrument observation or cleaning;
(b) the hazards to personnel that could result from an electric arc occurring during each task, and the hazards to personnel that could result from the electric arc;
(c) the methods to be used to help to prevent electric arcs; and
(d) the methods to be used to protect personnel from hazards resulting from electric arcs within electrical equipment.

8.3 Calculations to be submitted

8.3.1 The following calculations are to be conducted and used in the hazard identification and assessment:

(a) Calculations of the maximum current that would flow through an electric arc between each conductor and its adjacent conductor, and between each conductor and the exposed conductive parts of the enclosure, in the case of an arcing fault;
(b) The maximum incident energy at the intended working distance in the case of an arcing fault; and
(c) The distance from each conductor at which the incident energy would be 5 Joules (1,2 calories) per centimetre squared in the case of an arcing fault when the enclosure door is open.

These calculations may be made in accordance with a relevant Standard acceptable to LR, for example, IEEE Standard 1584, *IEEE Guide for Performing Arc-Flash Hazard Calculations*.

8.4 Testing and trials

8.4.1 It is to be demonstrated that, where provided, arrangements to detect arcing faults function correctly.

Existing Sections 8 *to* 20 *have been renumbered* Sections 9 *to* 21.

Section ~~10~~ 11

Electrical cables and busbar trunking systems (busways)

~~10.8~~ 11.8 Installation of electric cables

~~*10.8.10* Where single cables, or bundles of cables grouped in accordance with Table 1.10.8, run parallel with cables or bundles of cables of a different group for a distance greater than 1 m, a minimum separation distance of 0,1 m is to be ensured to reduce mutual interference.~~

Existing paragraphs 10.8.11 *to* 10.8.22 *have been renumbered* 11.8.10 *to* 11.8.21.

~~10.16~~ 11.16 Joints and branch circuits in cable systems

~~*10.16.1*~~ *11.16.1* If a joint is necessary it is to be carried out so that all conductors are adequately secured, insulated and protected from atmospheric action. The flame retardant properties ~~or fire resisting properties~~ of the cable are to be retained, the continuity of metallic sheath, braid or armour is to be maintained and the current carrying capacity of the cable is not to be impaired.

Section ~~11~~ 12

Batteries

~~11.3~~ 12.3 Location

~~*11.3.10*~~ *12.3.10* Only electrical equipment necessary for operational reasons and for the provision of lighting is to be installed in compartments provided in compliance with ~~11.3.1~~ 12.3.1, the compartment ventilation exhaust ducts and zones within a 1,5 m radius of the ventilation outlet(s). Such electrical equipment is to be certified for group IIC gases and temperature Class T1 in accordance with IEC 60079: *Electrical apparatus for explosive gas atmospheres*, or an acceptable and relevant National Standard.

Effective date 1 January, 2012

■ *Section ~~16~~ 17*
Fire safety systems

~~16.1~~ 17.1 Fire detection and alarm systems

17.1.1 Fire detection and alarm systems are to be in accordance with Chapter 9 of the Fire Safety Systems Code (FSS Code) and 17.1.2 to 17.1.19.

Existing paragraphs 16.1.1 *to* 16.1.7 *have been renumbered* 17.1.2 *to* 17.1.8.

~~16.1.8~~ 17.1.9 Detectors and manually operated call points are to be grouped into sections. The activation of any detector or manually operated call point is to initiate a visual and audible fire signal at the control panel and indicating units. If the signals have not received attention within two minutes an audible alarm is to be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces of Category A. For craft required to comply with the HSC Code, there is to be no time delay for the audible alarms in crew accommodation areas, following initiation of an audible and visual alarm at the control panel and indicating units, when all the control stations are unattended. This alarm sounder system need not be an integral part of the detection system.

Existing paragraphs 16.1.9 *to* 16.1.18 *have been renumbered* 17.1.10 *to* 17.1.19.

~~*16.1.19* Where it is intended that detectors be installed in external locations, e.g. cabin balconies, in addition to meeting the requirements for an environmental category suitable for open decks (*see* Ch 1,2.8.8), they are also to be tested for sun irradiation and ultraviolet exposure with satisfactory results.~~

~~*16.1.20* Detectors fitted in cabins on yachts, when activated, are also to be capable of emitting, or cause to be emitted, an audible alarm within the space where they are located.~~

Effective date 1 July, 2012

■ *Section ~~20~~ 21*
Testing and trials

~~20.2~~ 21.2 Trials

~~20.2.4~~ 21.2.4 It is to be demonstrated that the Rules have been complied with in respect of:

(a) satisfactory performance of each generator throughout a run at full rated load;

(b) temperature of joint, connections, circuit-breakers and fuses;

(c) the operation of engine governors, synchronising devices, overspeed trips, reverse-current, reverse-power and over-current trips and other safety devices;

(d) voltage regulation of every generator when full rated load is suddenly thrown off and when starting the largest motor connected to the system;

(e) voltage drop at the worst case condition;

(f) harmonic distortion of the voltage waveform, where declared;

~~(g)~~ satisfactory parallel operation, and kW and KVA load sharing of all generators capable of being operated in parallel at all loads up to normal working load;

~~(h)~~ alarm sound pressure levels; and

~~(i)~~ all essential and other important equipment are to be operated under service conditions, though not necessarily at full load or simultaneously, for a sufficient length of time to demonstrate that they are satisfactory.

~~*20.2.5* Voltage drop is to be measured, where necessary, to verify that this is not in excess of that specified in 1.7 or 19.9. Where necessary, measurements are to be taken as part of the trials specified in 20.2.4 (c), (d), (e) and (f), to verify that the installation will provide a quality of power supply in accordance with the values listed in 1.7.~~

21.2.5 Measurements are to be taken as part of the trials specified in 21.2.4(c), (d), (e) and (f) to verify that the installation will provide a quality of power supply in accordance with the values listed in 1.7.

Part 17, Chapter 1

Fire Protection, Detection and Extinction – General

Effective date 1 July, 2012

■ *Section 1*
General requirements

1.1 Application

1.1.2 Consideration will be given to the acceptance of fire safety measures:

(a) which, for Service Craft, have been prescribed and approved by the Government of the Flag State. In this instance, the requirements of Chapter 2 and Chapter 4 of these Rules are not applicable;

(b) which, for yachts, have been prescribed and approved by the Government of the Flag State, provided ~~that~~ these are shown to be equivalent to those required by the MCA LY2 Code as amended. In this instance, the requirements of Chapter 3 and Chapter 4 of these Rules are not applicable; ~~or~~

(c) where the arrangements are considered equivalent to those required by these Rules as a result of risk assessment studies; or

(d) where the arrangements are considered acceptable compared to those required by these Rules, due cognisance having been taken of any restricted service limits.

Section numbering in brackets reflects any Section renumbering necessitated by any of the Notices that update the current version of the Special Service Craft Ships

Part 10, Chapter 1

13.3.2(c)	*Reference* Pt 16, Ch 1,2.3.12 *now reads* Pt 16, Ch 1,2.3.14
14.2.6	*Reference* Pt 16, Ch 1,6.2.1 *now reads* Pt 16, Ch 1,7.2.1

Part 15, Chapter 1

8.2.4	*Reference* Pt 16, Ch 2,1.12 *now reads* Pt 16, Ch 2,1.13
8.6.6	*Reference* Pt 16, Ch 2,1.12 *now reads* Pt 16, Ch 2,1.13

Part 16, Chapter 1

1.1.3	*Reference* Section 3 *now reads* Section 4
1.1.4	*Reference* Section 4 *now reads* Section 5 *(Twice)*
1.2.3	*Reference* 6.4.1 *now reads* 7.4.1
1.2.10 ***(1.2.9)***	*Reference* Ch 2,10 *now reads* Ch 2,11
2.3.13 ***(2.3.15)***	*Reference* 6.1.2 *now reads* 7.1.2
2.8.7	*Reference* Ch 2,16.1 *now reads* Ch 2,17.1
2.9.3	*Reference* 16.3.12 *now reads* 17.3.12
2.10.7	*Reference* 3.2 *now reads* 4.2
2.10.12	*Reference* Ch 2,1.2.7 *now reads* Ch 2,1.2.10 *Reference* 11.7 *now reads* 12.7
2.11.6	*Reference* 3.2 *now reads* 4.2
2.11.9	*Reference* Ch 2,10 *now reads* Ch 2,11
2.13.1	*Reference* Ch 2,1.5 *now reads* Ch 2,1.6
2.13.7	*Reference* 3.2 *now reads* 4.2
2.14.1	*Reference* Ch 2,16 to 18 *now reads* Ch 2,17 to 19
3.1.1 ***(4.1.1)***	*Reference* 3.2 to 3.7 *now reads* 4.2 to 4.7
3.2.3 ***(4.2.3)***	*Reference* 2.2.3 *now reads* 2.2.4
4.1.1 ***(5.1.1)***	*Reference* 3.1.1 *now reads* 4.1.1
4.1.3 ***(5.1.3)***	*Reference* 3.6 *now reads* 4.6
4.1.4 ***(5.1.4)***	*Reference* 4.2 *now reads* 5.2
4.2.1 ***(5.2.1)***	*Reference* 4.2.2 to 4.2.7 *now reads* 5.2.2 to 5.2.7
4.2.6 ***(5.2.6)***	*Reference* 4.2.5 *now reads* 5.2.5
5.1.2 ***(6.1.2)***	*Reference* Section 3 and 4 *now reads* Section 4 and 5
5.1.3 ***(6.1.3)***	*Reference* 5.2 *now reads* 6.2
5.1.3 ***(6.1.3)***	*Reference* 5.3 *now reads* 6.3
6.2.1 ***(7.2.1)***	*Reference* 6.1 *now reads* 7.1
6.3.1 ***(7.3.1)***	*Reference* 6.1 *now reads* 7.1
13.5.2(e)	*Reference* 6.1.3 *now reads* 7.1.3

Part 16, Chapter 2

1.1.1	*Reference* Section 19 *now reads* Section 20 *Reference* 20 *now reads* 21
1.2.4 ***(1.2.6)***	*Reference* 10.6.2 *now reads* 11.6.2
1.2.6 ***(1.2.9)***	*Reference* Section 11 *now reads* Section 12
1.2.7 ***(1.2.10)***	*Reference* 11.7 *now reads* 12.7
1.2.9 ***(1.2.12)***	*Reference* 16.3.11 *now reads* 17.3.11
1.2.9 ***(1.2.12)***	*Reference* 16.3.12 *now reads* 17.3.12
1.2.10 ***(1.3.2)***	*Reference* 1.10.2 *now reads* 1.11.2
1.2.13 ***(1.3.4)***	*Reference* 1.6.3 *now reads* 1.7.3
1.2.14 ***(1.3.5)***	*Reference* 10.13 *now reads* 11.13
1.3.4 ***(1.4.4)***	*Reference* 1.3.2 *now reads* 1.4.2 *Reference* 1.3.3 *now reads* 1.4.3
1.4.3 ***(1.5.3)***	*Reference* 11.3 *now reads* 12.3 *Reference* 11.4 *now reads* 12.4 *Reference* 11.5.9 *now reads* 12.5.9
1.4.4 ***(1.5.4)***	*Reference* 1.2.3 *now reads* 1.2.5 *Reference* 1.2.4 *now reads* 1.2.6
1.4.5 ***(1.5.5)***	*Reference* 14.3 *now reads* 15.3 *Reference* 14.3.5 *now reads* 15.3.5 *Reference* 14.3.6 *now reads* 15.3.6
1.5.3 ***(1.6.3)***	*Reference* 1.5.1 *now reads* 1.6.1 *Reference* 1.5.2 *now reads* 1.6.2
1.8.5 ***(1.7.5)***	*Reference* 1.8.4 *now reads* 1.9.4
1.8.6 ***(1.7.6)***	*Reference 1.8.4 now reads 1.9.4*
1.10.1(a) ***(1.11.1(a))***	*Reference* 1.11.2(h) *now reads* 1.12.2(h)
1.10.3(c) ***(1.11.3(c))***	*Reference* 1.8 *now reads* 1.9
1.10.3(d) ***(1.11.3(d))***	*Reference* Section 13 *now reads* Section 14
1.10.4 ***(1.11.4)***	*Reference* 1.14.4 *now reads* 1.16.4
1.10.7 ***(1.11.7)***	*Reference* 10.15 *now reads* 11.15
1.10.12 ***(1.11.14)***	*Reference* 1.9 *now reads* 1.10
1.11.1 ***(1.12.1)***	*Reference* 1.11.2 *now reads* 1.12.2
1.11.2 ***(1.12.2)***	*Reference* 1.11.1 *now reads* 1.12.1
1.11.4 ***(1.12.4)***	*Reference* 13.1 *now reads* 14.1
1.11.6 ***(1.12.6)***	*Reference* 1.11.2 *now reads* 1.12.2
1.12.3 ***(1.13.3)***	*Reference* 1.11.7 *now reads* 1.12.7 *Reference* 1.11.9 *now reads* 1.12.9
1.13.3 ***(1.15.3)***	*Reference* 1.14 *now reads* 1.16
1.13.4 ***(1.15.4)***	*Reference* 1.14 *now reads* 1.16
1.14.1 ***(1.16.1)***	*Reference* 16.6 *now reads* 17.6 *Reference* 17.4.3 *now reads* 18.4.3
1.14.2 ***(1.16.2)***	*Reference* 10.5.3 *now reads* 11.5.3
1.14.4 ***(1.16.4)***	*Reference* 1.10.4 *now reads* 1.11.4
1.15.2 ***(1.17.2)***	*Reference* 1.15.1 *now reads* 1.17.1
1.16.2 ***(1.18.2)***	*Reference* 1.16.1 *now reads* 1.18.1
2.2.3	*Reference* 1.5.1 *now reads* 1.6.1
2.4.1	*Reference* 1.7.2 *now reads* 1.8.2
3.1.1	*Reference* Section 19 *now reads* Section 20
3.2.7(h)	*Reference* 16.10.1 *now reads* 17.10.1
5.7.4	*Reference* Section 17 *now reads* Section 18
5.8.1	*Reference* 1.5.1 *now reads* 1.6.1
6.1.4	*Reference* 1.2.3 *now reads* 1.2.5 *Reference* 1.2.4 *now reads* 1.2.6
6.1.7	*Reference* 11.3.5 *now reads* 12.3.5
6.9.1(b)	*Reference* 1.5.2 *now reads* 1.6.2
6.11.1	*Reference* 14.1 *now reads* 15.1
7.18.2	*Reference* Section 20 *now reads* Section 21
8.1.2 ***(9.1.2)***	*Reference* 1.3 *now reads* 1.4
8.1.6 ***(9.1.6)***	*Reference* 1.9 *now reads* 1.10
8.2.1 ***(9.2.1)***	*Reference* 8.3 *now reads* 9.3 *(Twice)*
8.3.1 ***(9.3.1)***	*Reference* 1.8 *now reads* 1.9 *Reference* Table 2.8.1 *now reads* Table 2.9.1

Cross-references

8.3.2 ***(9.3.2)***	*Reference* 1.8 *now reads* 1.9
8.3.3 ***(9.3.3)***	*Reference* 1.8 *now reads* 1.9 *(Twice)*
8.8.3 ***(9.8.3)***	*Reference* Section 20 *now reads* Section 21
Table 2.8.1 ***(Table 2.9.1)***	*Reference* 1.8 *now reads* 1.9
9.1.1 ***(10.1.1)***	*Reference* 9.1.2 to 9.1.11 *now reads* 10.1.2 to 10.1.11
9.1.2 ***(10.1.2)***	*Reference* 1.8 *now reads* 1.9
9.1.4 ***(10.1.4)***	*Reference* 1.8 *now reads* 1.9
9.1.6 ***(10.1.6)***	*Reference* 1.7 *now reads* 1.8
9.1.12 ***(10.1.12)***	*Reference* 1.3.2 *now reads* 1.4.2 *Reference* 1.3.3 *now reads* 1.4.3
9.1.12(d) ***(10.1.12(d))***	*Reference* 9.1.9 *now reads* 10.1.9
9.2.1 ***(10.2.1)***	*Reference* 9.2.2 to 9.2.18 *now reads* 10.2.2 to 10.2.18
9.2.2 ***(10.2.2)***	*Reference* 1.8 *now reads* 1.9
9.2.11 ***(10.2.11)***	*Reference* 1.7.3 *now reads* 1.8.3
9.2.16 ***(10.2.16)***	*Reference* 1.7 *now reads* 1.8
9.2.18 ***(10.2.18)***	*Reference* 1.3.2 *now reads* 1.4.2 *Reference* 20.1 *now reads* 21.1
9.3.1 ***(10.3.1)***	*Reference* 9.1 *now reads* 10.1 *Reference* 9.2 *now reads* 10.2 *Reference* 11 *now reads* 12
9.3.8 ***(10.3.8)***	*Reference* 11.3.5 *now reads* 12.3.5 *Reference* 11.5.10 *now reads* 12.5.10
9.3.10 ***(10.3.10)***	*Reference* 1.4 *now reads* 1.5
9.3.12 ***(10.3.12)***	*Reference* 1.3.2 *now reads* 1.4.2
10.1.1 ***(11.1.1)***	*Reference* 10.1 to 10.16 *now reads* 11.1 to 11.16 *Reference* 10.16 *now reads* 11.16
10.1.2 ***(11.1.2)***	*Reference* Table 2.10.1 *now reads* Table 2.11.1
10.2.1(b) ***(11.2.1(b))***	*Reference* Section 20 *now reads* Section 21
10.2.1(d) ***(11.2.1(d))***	*Reference* 10.1.2 *now reads* 11.1.2
10.2.2 ***(11.2.2)***	*Reference* 10.1.2 *now reads* 11.1.2
10.3.1 ***(11.3.1)***	*Reference* 10.8.15(b) *now reads* 11.8.15(b)
10.4.2 ***(11.4.2)***	*Reference* Table 2.10.2 *now reads* Table 2.11.2 *Reference* 10.1.2 *now reads* 11.1.2
10.4.3 ***(11.4.3)***	*Reference* Table 2.10.2 *now reads* Table 2.11.2 *Reference* 10.1.2 *now reads* 11.1.2
10.5.2 ***(11.5.2)***	*Reference* 10.5.1 *now reads 11.5.1*
10.5.5 ***(11.5.5)***	*Reference* 10.8.7 *now reads* 11.8.7 *Reference* 10.8.8 *now reads* 11.8.8
10.6.1 ***(11.6.1)***	*Reference* 10.7 *now reads* 11.7
10.6.3 ***(11.6.3)***	*Reference* Table 2.10.3 *now reads* Table 2.11.3 *Reference* Table 2.10.4 *now reads* Table 2.11.4 *(Twice)* *Reference* Table 2.10.2 *now reads* Table 2.11.2
10.6.4 ***(11.6.4)***	*Reference* 1.7 *now reads* 1.8
10.6.5 ***(11.6.5)***	*Reference* 1.11.8 *now reads* 1.12.8
10.6.6 ***(11.6.6)***	*Reference* 10.7.4 *now reads* 11.7.4
10.7.1 ***(11.7.1)***	*Reference* 10.7.2 to 10.7.5 *now reads* 11.7.2 to 11.7.5
10.7.3 ***(11.7.3)***	*Reference* Table 2.10.3 *now reads* Table 2.11.3 *Reference* Table 2.10.5 *now reads* Table 2.11.5

10.8.2 ***(11.8.2)***	*Reference* Table 2.10.6 *now reads* Table 2.11.6
10.8.14 ***(11.8.14)***	*Reference* 1.11 *now reads* 1.12
10.8.18 ***(11.8.18)***	*Reference* 10.14 *now reads* 11.14
10.8.18 ***(11.8.18)***	*Reference* 10.5.7 *now reads* 11.5.7
10.8.19 ***(11.8.19)***	*Reference* 10.9 *now reads* 11.9
10.8.20 ***(11.8.20)***	*Reference* 10.10 *now reads* 11.10
10.8.21 ***(11.8.21)***	*Reference* 10.11 *now reads* 11.11
10.8.22 ***(11.8.22)***	*Reference* 10.12 *now reads* 11.12
10.9.3 ***(11.9.3)***	*Reference* 1.11 *now reads* 1.12
10.10.1 ***(11.10.1)***	*Reference* 10.8.4 *now reads* 11.8.4
10.10.3 ***(11.10.3)***	*Reference* Table 2.10.7 *now reads* Table 2.11.7
10.10.4 ***(11.10.4)***	*Reference* Table 2.10.7 *now reads* Table 2.11.7
10.12.3 ***(11.12.3)***	*Reference* 10.8.2 *now reads* 11.8.2
10.15.1 ***(10.15.1)***	*Reference* 1.10.7 *now reads* 1.11.7
10.16.3 ***(11.6.3)***	*Reference* 10.5.3 *now reads* 11.5.3
10.17.1 ***(11.17.1)***	*Reference* 10.17.2 to 10.17.6 *now reads* 11.17.2 to 11.17.6
10.17.4 ***(11.17.4)***	*Reference* 1.9 *now reads* 1.10
11.3.4 ***(12.3.4)***	*Reference* 11.3.1 *now reads* 12.3.1 *Reference* 11.3.2 *now reads* 12.3.2 *Reference* 11.3.3 *now reads* 12.3.3
11.3.5 ***(12.3.5)***	*Reference* 11.5.10 *now reads* 12.5.10 *Reference* 11.6.4 *now reads* 12.6.4 *Reference* 11.6.5 *now reads* 12.6.5
11.3.10 ***(12.3.10)***	*Reference* 11.3.1 *now reads 12.3.1*
11.3.11 ***(12.3.11)***	*Reference* 1.4.3 *now reads* 1.5.3
11.5.1 ***(12.5.1)***	*Reference* 11.5.2 *now reads* 12.5.2
11.5.5 ***(12.5.5)***	*Reference* 11.5.9 *now reads* 12.5.9
11.5.6 ***(12.5.6)***	*Reference* 11.3.2 *now reads* 12.3.2 *Reference* 11.3.3 *now reads* 12.3.3 *Reference* 11.3.5 *now reads* 12.3.5
11.5.11 ***(12.5.11)***	*Reference* 11.5.10 *now reads* 12.5.10
11.7.2 ***(12.7.2)***	*Reference* 1.4.3 *now reads* 1.5.3
11.7.3 ***(12.7.3)***	*Reference* 1.4.2 *now reads* 1.5.2
12.3.1 ***(13.3.1)***	*Reference* Table 2.12.1 *now reads* Table 2.13.1
12.4.1 ***(13.4.1)***	*Reference* Table 2.12.1 *now reads* Table 2.13.1
14.1.1 ***(15.1.1)***	*Reference* 14.1.2 to 14.1.7 *now reads* 15.1.2 to 15.1.7
14.1.6 ***(15.1.6)***	*Reference* 14.1.5 *now reads* 15.1.5
14.3.5 ***(15.3.5)***	*Reference* 1.4.5 *now reads* 1.5.5 *Reference* 14.3.4 *now reads* 15.3.4
14.3.6 ***(15.3.6)***	*Reference* 14.3.5 *now reads* 15.3.5
14.3.7 ***(15.3.7)***	*Reference* 14.3.1 *now reads* 15.3.1
14.3.8 ***(15.3.8)***	*Reference* 14.3.4 *now reads* 15.3.4 *Reference* 14.3.5 *now reads* 15.3.5
14.3.9 ***(15.3.9)***	*Reference* 14.3.1 *now reads* 15.3.1
16.1.1 ***(17.1.1)***	*Reference* 10.6.4 *now reads* 11.6.4
16.1.2 ***(17.1.2)***	*Reference* 1.13 *now reads* 1.15
16.1.2 ***(17.1.2)***	*Reference* 1.14 *now reads* 1.16
16.1.12 ***(17.1.12)***	*Reference* 16.1.17 *now reads* 17.1.18
16.3.3 ***(17.3.3)***	*Reference* 1.13 *now reads* 1.15 *Reference* 1.14 *now reads* 1.16
16.3.5 ***(17.3.5)***	*Reference* 16.3.6 to 16.3.10 *now reads* 17.3.6 to 17.3.10
16.3.8 ***(17.3.8)***	*Reference* 1.10.1 *now reads* 1.11.1
16.3.9 ***(17.3.9)***	*Reference* 1.2.9 *now reads* 1.2.12
16.3.9 ***(17.3.9)***	*Reference* 16.3.8 *now reads* 17.3.8
16.3.9(a) ***(17.3.9(a))***	*Reference* 16.3.6 *now reads* 17.3.6
16.3.9(a) ***(17.3.9(a))***	*Reference* 16.3.7 *now reads* 17.3.7

16.3.10 ***(17.3.10)***	*Reference* 16.3.9 *now reads* 17.3.9
16.3.11 ***(17.3.11)***	*Reference* 16.3.12 to 16.3.14 *now reads* 17.3.12 to 17.3.14
16.6.3 ***(17.6.3)***	*Reference* 16.6.2 *now reads* 17.6.2
16.6.4 ***(17.6.4)***	*Reference* 16.6.2 *now reads* 17.6.2
16.6.5 ***(17.6.5)***	*Reference* 16.6.2 *now reads* 17.6.2
16.6.10 ***(17.6.10)***	*Reference* 10.5.3 *now reads* 11.5.3
16.6.12 ***(17.6.12)***	*Reference* 16.6.11 *now reads* 17.6.11
16.7.1 ***(17.7.1)***	*Reference* 1.13 *now reads* 1.15 *Reference* 1.14 *now reads* 1.16
16.9.1 ***(17.9.1)***	*Reference* 1.13 *now reads* 1.15 *(Twice)* *Reference* 1.14 *now reads* 1.16
17.1.3 ***(18.1.3)***	*Reference* 17.4 *now reads* 18.4
17.2.1 ***(18.2.1)***	*Reference* 1.13 *now reads* 1.15 *Reference* 1.14 *now reads* 1.16
17.2.2 ***(18.2.2)***	*Reference* 1.13 *now reads* 1.15 *Reference* 19.10 *now reads* 20.10
17.2.6 ***(18.2.6)***	*Reference* 20.2 *now reads* 21.2
17.3.2 ***(18.3.2)***	*Reference* 1.13 *now reads* 1.15 *Reference* 1.14 *now reads* 1.16 *Reference* 19.10 *now reads* 20.10
17.3.9 ***(18.3.9)***	*Reference* 17.2 *now reads* 18.2
17.3.11 ***(18.3.11)***	*Reference* 20.2 *now reads* 21.2
17.4.2 ***(18.4.2)***	*Reference* 1.14 *now reads* 1.16
17.4.3 ***(18.4.3)***	*Reference* 10.5.3 *now reads* 11.5.3 *Reference* 11.3.7 *now reads* 12.3.7
18.2.2 ***(19.2.2)***	*Reference* 18.1 *now reads* 19.1
19.2.1 ***(20.2.1)***	*Reference* Section 11 *now reads* Section 12 *Reference* 19.2.2 to 19.2.6 *now reads* 20.2.2 to 20.2.6 *Reference* 19.2.7 *now reads* 20.2.7
19.2.5 ***(20.2.5)***	*Reference* 19.12 *now reads* 20.12
19.3.1 ***(20.3.1)***	*Reference* Section 20 *now reads* Section 21
19.7.1 ***(20.7.1)***	*Reference* 19.7.2 *now reads* 20.7.2
19.7.2 ***(20.7.2)***	*Reference* 19.7.1 *now reads* 20.7.1
19.10.2 ***(20.10.2)***	*Reference* 19.10.1 *now reads* 20.10.1
19.10.4(a) ***(20.10.4(a))***	*Reference* 19.10.3(a) *now reads* 20.10.3(a) *Reference* 19.9.1 *now reads* 20.9.1 *(Twice)*
19.10.4(b) ***(20.10.4(b))***	*Reference* 19.10.2 *now reads* 20.10.2
19.11.1 ***(20.11.1)***	*Reference* Section 10 *now reads* Section 11
19.14.1 ***(20.14.1)***	*Reference* 16.1 *now reads* 17.1
19.15.1 ***(20.15.1)***	*Reference* 17.2 *now reads* 18.2
19.15.1 ***(20.15.1)***	*Reference* 17.3 *now reads* 18.3
20.1.1 ***(21.1.1)***	*Reference* 20.1.2 to 20.1.4 *now reads* 21.1.2 to 21.1.4
20.1.2 ***(21.1.2)***	*Reference* Table 2.20.1 *now reads* Table 2.21.1
20.1.4 ***(21.1.4)***	*Reference* Table 2.20.2 *now reads* Table 2.21.2
20.2.1 ***(21.2.1)***	*Reference* 20.2.2 to 20.2.7 *now reads* 21.2.2 to 21.2.7
20.2.2 ***(21.2.2)***	*Reference* Table 2.20.2 *now reads* Table 2.21.2
20.2.5 ***(21.2.5)***	*Reference* 19.9 *now reads* 20.9
20.2.3(b) ***(21.2.3(b))***	*Reference* 1.11.2 *now reads* 1.12.2 *Reference* 19.7.2 *now reads* 20.7.2
20.2.5 ***(21.2.5)***	*Reference* 1.7 *now reads* 1.8 *(Twice)*

Part 17, Chapter 2

2.4.2(a)	*Reference* 16.6.7 *now reads* 17.6.7
2.8.1	*Reference* 16.6 *now reads* 17.6
2.8.7	*Reference* Pt 16, Ch 2,11.5 *now reads* Pt 16, Ch 2,12.5

Part 17, Chapter 3

2.4.2(a)	*Reference* 16.6.7 *now reads* 17.6.7
2.8.1	*Reference* 16.5 *now reads* 17.5
2.8.7	*Reference* Pt 16, Ch 2,11.5 *now reads* Pt 16, Ch 2,12.5
2.20.1(e)	*Reference* Pt 16, Ch 2,13 *now reads* Pt 16, Ch 2,14
3.16.11	*Reference* 16.5 *now reads* 17.5
3.24.5	*Reference* 17.3 *now reads* 18.3
3.34.1(e)	*Reference* Pt 16, Ch 2,13 *now reads* Pt 16, Ch 2,14

Part 17, Chapter 4

1.2.1	*Reference* Pt 16, Ch 2,16.2 *now reads* Pt 16, Ch 2,17.2
2.1.2	*Reference* Pt 16, Ch 2,16.1 *now reads* Pt 16, Ch 2,17.1

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